

PATENT SPECIFICATION

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IMPROVEMENTS IN OR RELATING TO CONTROL OF FLUID FLOW

(71) We, CRINOSPITAL SPA, an Italian company, of Via Crema, Palazzo Pignone, Crinone, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:
This invention relates to a device for controlling the flow of fluid through a flexible tube. The invention is particularly but not exclusively useful in connection with medical/therapeutic applications, such as transfusions, infusions, perfusions, hyperosmotic and also laboratory or chemical applications, where a precise metering of fluid flow at low throughput is required.
The apparatus already known for infusions or transfusions generally comprises a reservoir for the liquid to be infused, which is connected, through a flexible tube, to a stopcock chamber or stop having a second flexible tube extending therefrom and which can fit the injection needle. To the latter flexible tube, at an intermediate location between the stop and the needle, a clamp is fitted for controlling the infusion liquid flowrate. Such clamps, or similar means, presently in use do not give good control of the flowrate which is likely to fluctuate during the operating period. In fact such clamps or similar means, when in the operative position, press tightly the flexible tube walls so that the tube walls become flattened and warped, while two very sharp edges are simultaneously formed, which lead to buckle the tube wall in a transverse direction. When the clamp is then wholly or partially released, to allow for the passage of a controlled flow of liquid, the original setting tends to change since the substantially resilient material of the tube walls cannot readjust instantaneously to the new operating conditions since it has been subjected to high stress. The effective cross-sectional area of the tube may therefore show slight variations, over a period,

directly affecting the rate of flow of the liquid therethrough.
The device according to this invention is designed to obviate the change of similar devices now in use, in order to give a more precise setting of the liquid flowrate, which is very important when, for medical or surgical purposes, the use of substantial and controlled quantities of particularly active or dangerous products is required.
In accordance with the invention, a device for controlling the flow of fluid through a flexible tube comprising a longitudinally extending hollow body with longitudinally opposed apertures which, for accommodating the tube, the body having a transverse apertured wall and tube engaging means operable through the aperture of said transverse wall for controlling the flow of liquid through the tube, wherein the said tube engaging means comprises a lever extending through the aperture of the transverse wall and is adapted for pivotal movement with respect to said aperture, said lever having an arm portion located outside the body and a hooked portion located with the body, said hooked portion carrying the periphery of the tube within the body, so that when in use pressure is applied to the arm portion of the lever to pivot it towards the body and to move the hooked portion towards the aperture in the transverse wall, the section of the hooked portion of the lever adjacent to the arm portion compresses the tube in one direction, with the section of the hooked portion of the lever adjacent to the arm portion compressing the tube in the opposite direction.
In a preferred embodiment of the invention the device comprises a hollow body having a pair of apertures through which a flexible tube can enter and leave the body, the body having an opening in which is mounted a control member comprising an arm portion exterior of the body and a hook portion within the body, the arrangement being such that in use pressure on the arm

portion to cause the arm to move in a direction towards the body concomitantly causes the hook portion to compress the walls of a flexible tube passing through the body, thus controlling the flow of fluid through the tube.
The hollow body may be formed from two substantially equal sized members fixed together with apertures through opposite walls of the members through which the flexible tube can pass.
Advantageously there is mounted on the hollow body a suitable structure means capable of use of retaining the control member in a desired operative position.
The device may be formed from a suitable metal or a rigid plastic material.
In order that the invention may be more clearly understood an embodiment thereof will now be described by way of example with reference to one of the accompanying drawings in which:
Figure 1 is a diagrammatic longitudinal cross-section through a control device for fluid flow through a flexible tube, the device being in its operative position; and
Figure 2 is another diagrammatic longitudinal cross-section showing the device of Figure 1 in an alternative operative position.

Referring now to the accompanying drawing, a device for controlling the flow of fluid through a flexible tube comprises a pair of members 1 and 2 fixed together to form a hollow rectangular body. Mounted in the member 1 is a slider 4 which operates on guide rails 5 and 6 extending in the body. The arm portion 7 is substantially straight and the hook portion 8 is of a shape such as to be capable in use of bearing on the outer wall of a tube 9 passing through the device so as to prevent flow of fluid therethrough. The flexible tube 9 can be connected to a rigid tube 10. A push rod 11 and a pivotal point 14 can be used to depress the arm portion 7 so as to cause the lever 8 to become operative.
The tube 9 is formed from a resilient material, preferably a non-cured rubber. The tube can be of substantially circular cross-section, although it is preferably of elliptical cross-section, so that deformation can occur easily in the direction of the minor axis of the ellipse.
To use the device as described above, the arm portion 7 is depressed by pressure applied via the push rod 11. The push rod 11 reciprocates in a direction as indicated by the arrow A. The push rod 11 is normally operated for small, constant flow-rates, such as for normal infusions. However the push rod may be controlled by an

automatic fitting when the flowrate varies with time and has to be continuously adjusted.
According to the pressure applied, the control lever can rotate any intermediate position between the two extreme positions indicated in Figures 1 and 2. Once the desired position has been set, it is possible to keep lever 3 in position, during normal operation, by slider 4 which reciprocates along guide rails 5 and 6. Figure 1 shows the completely locked position. Figure 2 shows the slider in its non-operative position with the lever held in non-operative position by the flexible tube 9.
The above-described, circular and appropriate assembly, which is applied protected and ready for service under the usual terms of an infusion or transfusion set. Such an assembly is normally used only once and is then disposed of after use.

WHAT WE CLAIM IS:-
1. A device for controlling the flow of a fluid through a flexible tube comprising a longitudinally extending hollow body with longitudinally opposed apertures and for accommodating the tube, the body having a transverse apertured wall and tube engaging means operable through the aperture of said transverse wall for controlling the flow of liquid through the tube, wherein the said tube engaging means comprises a lever extending through the aperture of the transverse wall and is adapted for pivotal movement with respect to said aperture, said lever having an arm portion located outside the body and a hooked portion located with the body, said hooked portion carrying the periphery of the tube within the body, so that when in use pressure is applied to the arm portion of the lever to pivot it towards the body and to move the hooked portion towards the aperture in the transverse wall, the section of the hooked portion of the lever adjacent to the arm portion compresses the tube in one direction, with the section of the hooked portion of the lever adjacent to the arm portion compressing the tube in the opposite direction.

2. A device as claimed in Claim 1, and further comprising an arm retaining means suitably mounted on the body for holding the lever in a fixed position.
3. A device for controlling the flow of fluid through a flexible tube, substantially as hereinbefore described with reference to and as shown in the accompanying drawing, and as shown in any preceding claim.
4. A flexible tube having fitted therein a device as claimed in any preceding claim.
5. An infusion or transfusion apparatus comprising a flexible tube as claimed in claim 4.

To see the device as described above, the arm portion 7 is depressed by pressure applied via the push rod 11. The push rod 11 reciprocates in a direction as indicated by the arrow A. The push rod 11 is normally operated for small, constant flow-rates, such as for normal infusions. However the push rod may be controlled by an

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The drawing is a reproduction of the Original in a reduced scale.

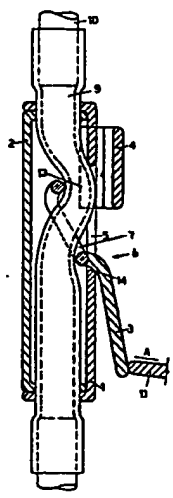


Fig. 1

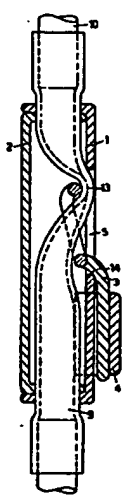


Fig. 2